

## Technical Efficiency of Egg Production in Osun State

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**Abstract:** The major objective of this study was to examine the technical efficiency of egg production in Osun State. Specifically, the study looked at the socio-economic characteristics which influence the technical efficiency of farmers. It estimated and analysed productivity and technical efficiencies of the poultry farms. Data were collected from 86 sampled egg producers with the aid of a structured questionnaire using multistage random sampling technique. The data collected were analysed using descriptive statistics, budgetary analysis and stochastic frontier production function. The study revealed that production of egg was profitable in the study area. Result also indicated that inputs were efficiently allocated and utilized and the farmers operated in the rational zone of production function (Stage II). The inefficiency model showed that only location of the poultry egg farm positively improved TE. It is recommended that farmers should therefore be encouraged to site their poultry farms close to their source of input and environment conducive for poultry production.

**Keywords:** Technical efficiency, productivity, egg production

### INTRODUCTION

The livestock industry is very important in the Nigerian economy because it provides a good source of animal protein such as meat, milk and egg that are rich in the essential amino acids required for body functions. Excess released from such products could as well be exported for foreign exchange. The industry, according to Okunmadewa (1999) provides raw materials such as wool, hides, and skin for the development of local industries using them to produce items such as clothing, shoes, jackets, rugs for human use. According to Akinwumi and Adeyeye (1979), poultry keeping have some advantages over other livestock because they are good converter of feed to useable protein in meat and eggs, production cost per unit is relatively

low, return to investment is high if properly taken care of and lastly it has a short production cycle such that capital is not tied down over a long period.

Poultry meat and eggs offer considerable potential for meeting human needs for dietary animal supply (Folorunsho and Onibi, 2005). Poultry production in the past was not recognised as an important occupation; it has developed and occupied a place of pride among the livestock enterprises due to its rapid monetary turnover (Laseinde, 1994). This single reason, among others has made the enterprise attractive and popular among small, medium, as well as large scale poultry farmers. The poultry industry has become a diverse industry with a variety of business interests such as egg

production, broiler production, hatchery, and poultry equipment business (Amos, 2006).

The population explosion together with a poor distribution of food is among the world's greatest problem today. In Nigeria, production of food has not increased at a rate that can meet the increasing population. In developed countries, growth of population in relation to farm output is rather stable but in a developing country like Nigeria there is no compensation for population increase by the total farm output.

Therefore, the importance of livestock for sustainability of food production and fostering of widespread provision of food production and fostering of widespread provision of animal-protein cannot be overemphasized. FAO (1989) recommendation for daily protein consumption is put at 60g per person out of which 35g is expected to be of animal source. However, it was reported that the average per capita protein intake in Nigeria was 51.7g of which only 8.6g came from animal sources, whereas in developed countries, the average per capita protein intake was over 90g with more than 65g of animal protein (Isoun, 1980)

The level of livestock consumption in Nigeria according to FAO (1989) is ridiculously too low. A report of the Federal Livestock Department according to the Federal Ministry of Agriculture (1988) confirmed that the total meat produced in Nigeria was actually 400,000 tonnes in spite of the projected figure by FAO of 850,000 tonnes for the year 1986. All these further indicate the decline in food supply and consumption, which eventually lead to wider nutrition and malnutrition of the populace.

Within the pattern of hunger and malnutrition in Nigeria the greatest problem is that which result from inadequate protein in the diets of a large proportion of the population especially rural areas. This according to Oyenuga (1990) was due to the fact that the purchasing power of the bulk of the population is low in relation to the prevailing high cost prices of nourishing foods. There is therefore, the need for efficiency in the management of the farm at production, distribution, marketing and consumption levels, to achieve the objectives of making farming profitable and providing adequate protein supplies in the Nigeria so as to bridge the gap between food production and population in the country.

The major sources of protein in developing countries are beef, pork, goat meat, and mutton and poultry meat while other sources termed miscellaneous are egg and milk which have a bulk share of animal protein required by man. It is necessary to note that adequate consumption of meat is an indication of social and economic welfare. Demand for animal protein is usually higher in cities than in villages because of the difference in income, level of education and availability (Ikeme, 1990).

To bridge the protein gap in Nigeria, egg as a major poultry product has been a topic of interest for many researchers. Akinwumi and Adeyeye (1979) showed that small scale farmers tend to operate their poultry units on part time basis, most of them concentrate on egg production alone and most large scale producers locate their farms near urban areas. In their study on Economic analysis of Nigeria poultry industry, the supply and demand for egg and

poultry meat were compared and it was confirmed that most of the producers concentrate on egg production alone and neglect the broiler production creating gap between demand and supply.

Adebiyi (2000) studied on the economic analysis of egg production in Ondo State and stated that apart from the high level of protein in egg, it is more easily affordable by the common man than other sources of protein. The study compared the purchasing price of a tray of egg and a kilogramme of beef and it was concluded that from the little difference in cost price that a tray of egg which consists of thirty pieces of eggs can be enough for the better part of a month unlike a kilogramme of beef or chicken which must be consumed within a maximum of a week. Moreover, boiled eggs are now being hawked in motor parks, railway stations, market places and roadsides. This therefore, justifies that more eggs would have been consumed if the prices were right.

The production of egg has been troubled by unstable trends in the economy. The several problems plaguing the industry make it difficult for existing firms to expand while new ones are reluctant to go into the business. Such problems include - high cost of feed, other production cost, diseases and marketing problems. This situation has forced many small-scale poultry farms to close down and those still managing to survive are producing at very high cost and also contending with serious inputs limitations. The problem then is how efficient are the available resources utilized in poultry production in the light of the situation of the economy? What effect has this on farmers that

are stills able to keep on with production at this high cost of inputs?

Results from this study will help to assess the impact of resources already committed to egg industry and the extent to which egg output can be increased from such existing resources. It is in view of this that the study examines the productivity and the technical efficiency of egg production in Osun State, Nigeria. Specifically, the study estimated the profitability of poultry egg production in the study area, the productivity of the factors involved in poultry egg production as well as the technical efficiency (TE) of poultry egg production in the state.

## **METHODOLOGY**

The study was carried out in five Local Government Areas of Osun state namely, Osogbo, Ede, Ife Central, Ikirun and Ilesha. Osun State has a total land area of 8802 Km<sup>2</sup>. The people are predominantly peasant farmers cultivating mostly food crops. They also embark on livestock production such as rearing of goats, sheep, pigs, rabbits and poultry as well as marketing of their products.

Primary data were collected from poultry farmers in the study area with the use of well-structured questionnaire. The respondents were selected using multistage random sampling technique. Firstly, local government areas were chosen purposively based on the population of poultry farmers in the local government area and availability of market for the poultry products. Eighty six respondents were randomly sampled from the local government areas covered by the study. The economic variables considered for

estimating efficiency of poultry egg productions are: quantity of eggs produced (Naira), stock of birds (Number), feed intake (Kg), operating expense (Naira), other cost (Naira), experience of farmer in years, years of schooling of farmers, age of farmers and location of farm (Urban/Rural area).

The profitability of the farm was estimated with the use of the budgetary analysis as given below

i. Gross Margin Technique

$$GM=TR-TVC \dots\dots (1)$$

ii. Net Revenue Analysis

$$= TR - TC; \text{ Where}$$

$$TC = TVC + TFC \text{ and } TR = PQ$$

$$\text{Therefore, } = PQ - TVC - TFC, \dots (2)$$

Where TR is Total Revenue from sales of eggs and birds, is Profit, P is Price of Unit egg and birds sold, Q is Quantity of eggs and birds sold and TVC is Total variable cost for birds and eggs. (This will include the cost of purchase of the birds, feeds, medication and cost of labour for feeding, watering and general management of birds). TFC is Total Fixed Cost which include cost of all fixed assets which can last for a year or more, TC is Total cost of production for eggs and birds

Econometric Method

The stochastic frontier production function analysis was used to estimate the coefficients of the parameters of the production function and also to predict the technical efficiencies of the poultry farms. The production technology of the farmer was assumed to be specified by the Cobb Douglas frontier production function which is define by

$$\log Y = \log P_0 + P_0 \log X_{1i} + \log X_{2i} + \log X_{3i} + 10gX_{4i} + V_i - U_i \dots\dots (3)$$

Where Y = Output of the Farmer

X1 = Stock of birds (number)

X2 = Feed Intake (kg)

X3 = Operating expenses (labour, Drugs, Transportation Cost)

X4 = Other costs (Depreciation)

V<sub>i</sub> = Random errors which covers random effects on production outside the control of the decision unit and.

U<sub>i</sub> = Technical inefficiency effect which are the result of behaviour factors which could be controlled by an efficient management (Xu & Jeffrey, 1998) V's are random errors which are assumed to be independent and identically distributed normal random error having zero means and unknown variance N. (U, v<sup>2</sup>)

U's are technical inefficiency effects, which are assumed to be independent of V's. Where U<sub>j</sub> is defined by:

$$U_j = \delta_0 + \delta_1 Z_{1j} + \delta_2 Z_{2j} + \delta_3 Z_{3j} + \delta_4 Z_{4j} \dots\dots (4)$$

Where Z<sub>1</sub>, Z<sub>2</sub>, Z<sub>3</sub>, Z<sub>4</sub> represent years of experience (years), level of education (years), age (years) and location of farm (urban/rural ) respectively. These are included in the model to indicate the possible influence of the farmers' socio -economic characteristics on the Technical efficiencies of the farms. The β<sub>s</sub>. δ<sub>s</sub> σ<sup>2</sup>, σ<sup>2</sup><sub>v</sub>, σ<sup>2</sup><sub>u</sub>, s, and γ are unknown scalar parameters to be estimated. The variances of the parameters systematic, V and one sided U v<sup>2</sup> and u<sup>2</sup>re respectively and the overall model variance given as <sup>2</sup> are related thus,

$$\delta^2 = \delta u^2 + \delta v^2 \dots\dots (5)$$

The measures of total variation of output from the frontier which can be attributed to technical efficiency are lamda ( ) arid gamma  $\gamma$  (Battese and Corra, 1977). These variability measures are derived as follows

$$= \delta u^2 / \delta v \dots\dots (6)$$

and

$$\gamma = \delta u^2 / \delta v^2 \dots\dots (7)$$

Also, the farm specific technical efficiency (TE) of the farmer is estimated by using the expectation of  $U_j$  conditional on the random variable ( $E_i$ ) as shown by Battese and Coelli (1988). The technical efficiency of an individual farmer is defined in terms of the ratio of the observed output to the corresponding frontier output given the available technology, that is

$$TE = Y_i / Y_i^*$$

$$= \frac{\exp(X_i\beta + V_j - U_j)}{\exp(X_i\beta - V_j)} \dots\dots (8)$$

$$= \exp. (- U_j)$$

So that  $0 \leq TE \leq 1$ .

**RESULT AND DISCUSSION**

The Gross margin analysis of poultry egg production in the study area is presented in Table 1 below. The major cost element in poultry egg production is the feed cost, which accounted for about 80% of the total cost of production. The gross margin per bird was N1,500.13 and the Net Return was N1,494.88. This implies that poultry egg production was profitable in the

study area and thus any effort at expanding it would be a good decision.

Table 1 Budgetary Analysis (Gross Margin and Net Returns Analysis of poultry egg production)

Variables	Mean Value (Naira)
Feed cost	1,726,923.20
Operating cost	416,825.65
Total Variable Cost (TVC)	2,143,748.86
Fixed Cost (FC)	14,413.07
Total Cost (TVC + FC)	2,158,162.53
Total Revenue (TR)	62,631,105.90
Gross Margin (TR- TVC)	4,119,357.04
Net Return (TR- TC)	410,493.37
Gross Margin Per Bird	1,500.13
Net Returns per bird	1,494.88

Productivity measurement showing the estimates of the parameters of the stochastic frontier production function of poultry egg farms in the study area is also presented in Table 2. The coefficient of the number of birds raised to produce the eggs was 0.52 and highly significant at 5% level of significance. The coefficient is positive and less than unity implying that increasing the number of birds for egg production by one would increase the revenue accruable by 52 kobo. In other words, the allocation and utilisation of this factor is in stage II of the production surface and thus it is efficiently allocated and utilised.

Table 2 Estimates of the parameters of production function of Poultry egg farms

Variables	Parameters	Coefficients	T-ratio
<b>General Model</b>			
Constant	$\beta_0$	3.81	8.77
Stock of birds	$\beta_1$	0.52	3.18
Feed	$\beta_2$	-0.09	-0.56
Operating expenses	$\beta_3$	0.24	1.51
Other cost	$\beta_4$	0.10	1.16

<b>Inefficiency Model</b>			
Constant	$\delta_0$	-3.68	-0.26
Experience	$\delta_1$	0.02	0.22
Educational level	$\delta_2$	0.31	0.40
Age of farmers	$\delta_3$	0.01	0.10
Location of farm	$\delta_4$	-0.34	-0.44
<b>Variance Parameters</b>			
Signa squared	$\delta^2$	0.87	0.55
Gamma	$\gamma$	0.83	2.79
Loglikelihood		-56.82	
Mean T.E		0.76	

The coefficient of operating expenses and other costs are positive and also less than unity but are not significant at 5% level of significance. This implies that the variables are efficiently allocated and utilized. The coefficient of feed is negative implying that total revenue from egg production decreases with increase in feed cost. This factor allocation is already in stage III of the production surface and to come back to the stage of efficiency the allocation has to be reduced. The Returns to Scale (RTS) (summation of the elasticity of production of the variables involved in the production process) of the poultry egg production is as presented in Table 3. The RTS is 0.77. It is positive and less than unity indicating that eggs production is in stage II (Rational Zone) of the production function and that inputs allocation and utilization are efficient.

Table 3 Elasticity of Production and Returns to scale (RTS)

Variables	Elasticity (EP)	Production
Stock of birds	0.52	
Feed	-0.09	
Operating expenses	0.24	
Other Cost	0.10	
RTS	0.77	

There is presence of technical inefficiency effects in the poultry egg production in the study area. This is confirmed by the large and significant value of the gamma coefficient ( $\gamma$ ). The gamma value of 0.83 indicates that about 83% variation in the output of the poultry egg production would be attributable to technical inefficiency effects alone while only 17% would be due to random effects. The predicted Technical Efficiencies of the poultry egg farm range, between 0.24 and 0.93 with a mean Technical Efficiency of 0.76. Table 4 presents the decile range of the Frequency distribution of the T E of the poultry egg farms. The frequency distribution of the TE shows that about 79% of the poultry egg farms have TE exceeding 70 percent.

The signs and significance of the Inefficiency model of the stochastic frontier, production function has important implications on the technical efficiency of the poultry farms. The coefficients of experience, educational level, and age of poultry egg farmers are positive but less than unity. This indicates that these factors lead to decrease in Technical Efficiency. The coefficient of location is negative and implies that the location of the poultry farm leads to increase in TE. The nearer the farm to the urban centre the higher the TE.

Table 4 Frequency Distribution of Decile Range of Technical Efficiency

Decile Range of T.E	Frequency	Percentage %
0.30 – 0.39	1	1.1
0.40 - 0.49	-	-
0.50 – 0.59	2	2.2
0.60 - 0.69	6	7.0
0.70 – 0.79	9	10.5
0.90 – 0.89	28	32.6
0.90 - 0.99	36	41.9
1.00	4	4.7

## CONCLUSION AND RECOMMENDATION

The study examined the Technical Efficiency (TE) of poultry egg production in five Local Government Areas of Osun State, Nigeria. Primary data were collected from 86 poultry egg farms from the selected Local Government Areas. Findings from the study showed poultry egg production was profitable in the study area as depicted by the large gross margin per bird of NI,500.13 and Net Returns per bird of NI,493.88. The study also confirmed that feed cost accounted for about 80% of production cost. The productivity analysis showed that apart from feed cost all the other factors showed positive decreasing returns to the factor. The Returns to scale was 0.77 which indicates stage II of the productivity surface showing an efficient allocation and utilization of resources. The Technical Efficiency measurement showed that there were technical inefficiency effects in poultry egg production. The predicated T. E. ranged between 0.24 and 0.93 with a mean of 0.76 and about 79% of farms having TE of over 0.70. This variation can be attributed to the presence of technical inefficiency effects in poultry egg production in the study area.

The inefficiency model showed that only location of the poultry egg farm positively improved TE while other socio-economic variables such as education, poultry keeping experience and age of the poultry farmers in the model are negative and insignificantly influence the TE. The varying level of technical efficiencies of poultry egg farms in the study area is ample opportunity to improve on the current level of efficiency. Farmers should

therefore be encouraged to site their poultry farms close to their source of input and to environment conducive for poultry production. Also, to stimulate egg consumption in the rural areas, adequate enlightenment on the benefit of egg consumption should be introduced.

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